Economics of Reprocessing and Recycling Nuclear Fuel

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Three alternative fuel cycles for managing Light Water Reactor (LWR) Spent Nuclear Fuel (SNF) have been identified: Alternative (1) is "Once-through" (open) uranium oxide (UOX) fuel cycle with temporary storage and final disposal in a geologic repository. Alternative (2) is "Twice-through" (partially closed), involving the reprocessing of SNF and recycling of MOX fuel in LWRs. Alternative (3) is fully closed, involving the reprocessing of SNF and recycling of actinide (plutonium plus others)-bearing fuels in Fast Reactors. However, for all three alternatives, a geologic repository is required for both new and legacy SNF and High Level Waste.

Thus, the first determination is not whether to store SNF and build a geologic repository, but rather how to determine what level of SNF reprocessing is most efficient, given U.S. resources and repository constraints. If it is determined that reprocessing should begin as soon as possible to employ future repository capacity more efficiently, then Alternative (2) is the best option, because Alternative (3) Fast Reactors will not be available commercially for two to three decades. If it is determined that repository capacity must be minimized, then Alternative (3) is the best option, because Alternative (2) cannot consume actinides as efficiently as Alternative (3). Employing all three alternatives is the least risky strategy, but some selection among alternatives must be done given budget constraints.

Proponents of Alternatives (2) and (3) assume that the U.S. government will pay a major portion of the costs. However, if Alternative (2) is not competitive at market costs of capital, and must rely on U.S. government subsidies, then Alternative (2) is not ready for U.S. commercial deployment. Until a repository is constructed, the cost of interim SNF storage is low enough that the U.S. government has time to solve the SNF problem scientifically, technically, economically, and equitably.

Given this, the most effective action that the U.S. government could undertake is defining, identifying, and siting at least one geologic repository, which will be required under Alternatives (1), (2), and (3). The decision whether to reprocess can be made after identifying a geologic repository of a particular capacity, so that the reprocessing technology that best optimizes that space can be selected. Hence, the identification of a geologic repository should be made as soon as possible so that the optimal SNF management strategy can be determined.

Finally, the Savannah River Site MOX facility, which is currently under construction by Shaw AREVA MOX Services, should provide important insights as to whether MOX fuel is commercially viable in the U.S. (without additional subsidies). If it is commercially viable, the U.S. Congress should update its decision not to invest in commercial aqueous reprocessing technology.